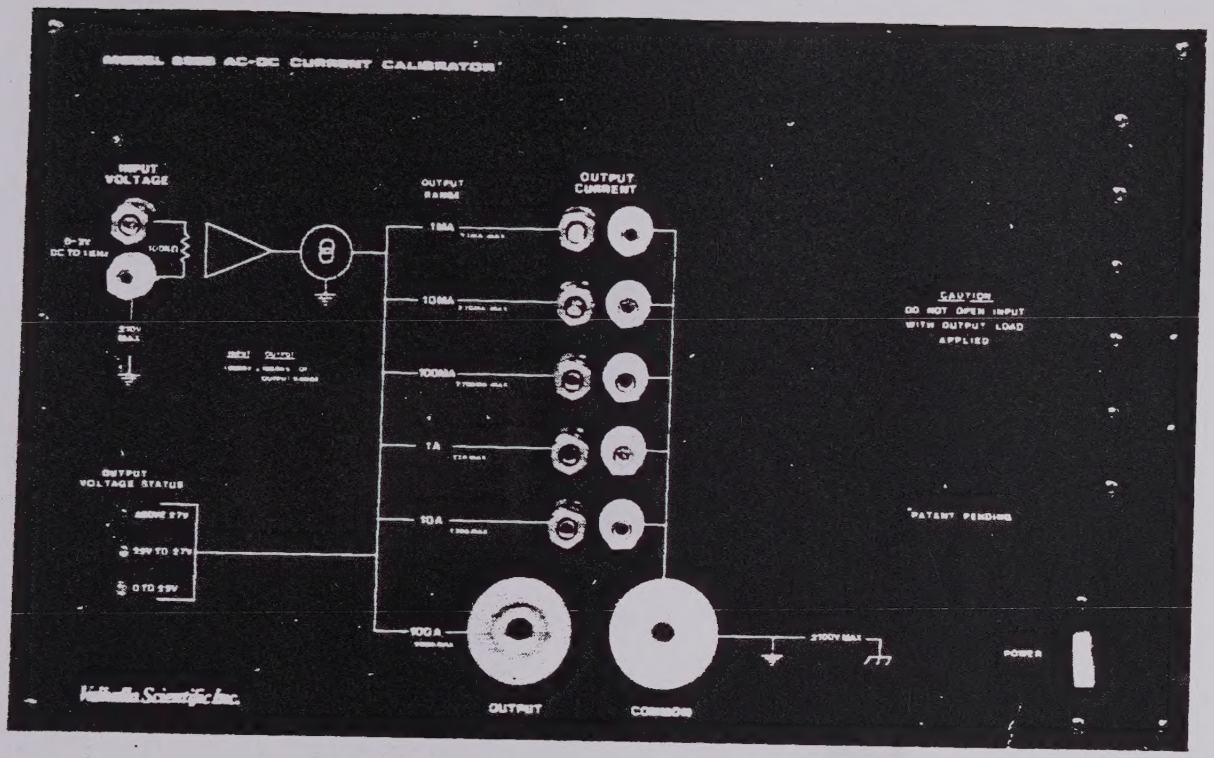
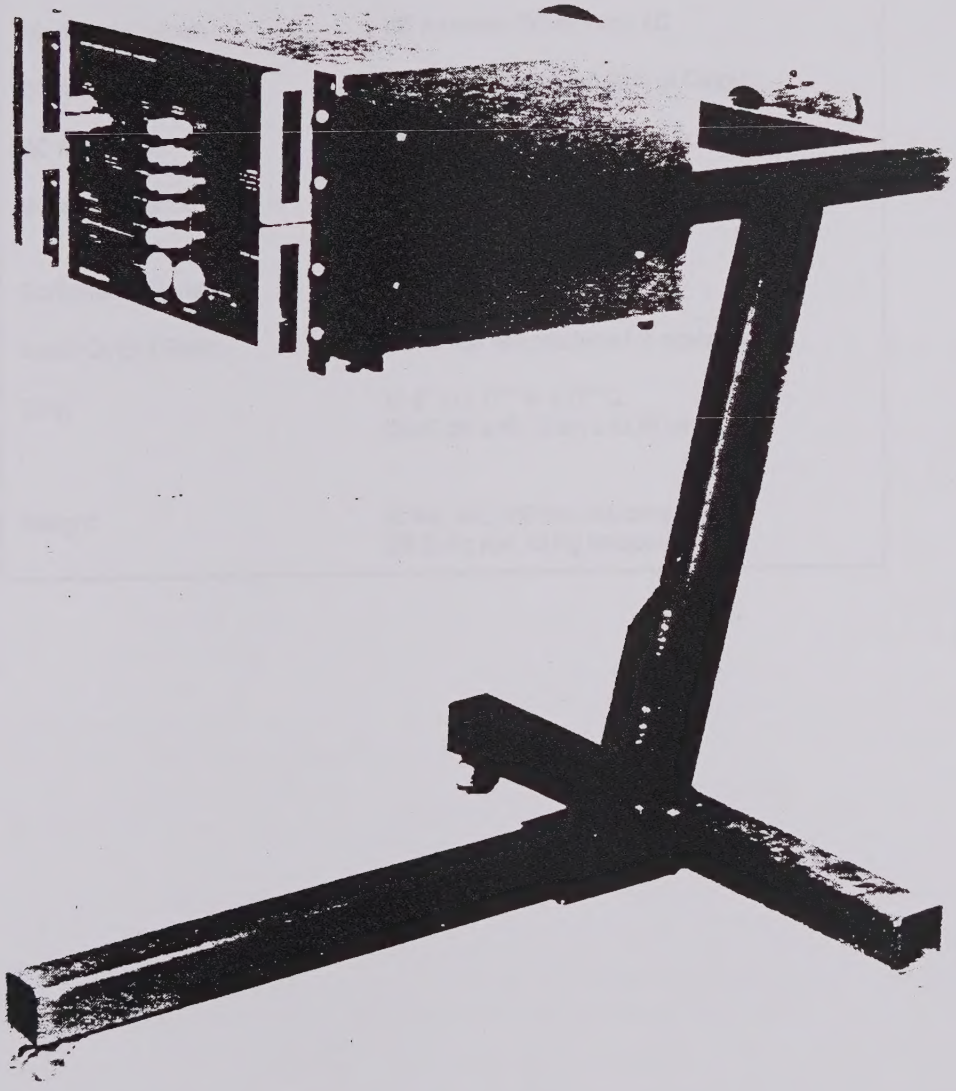


INSTRUCTION MANUAL MODEL 2555



MODEL 2555

AC-DC CURRENT CALIBRATOR

SPECIFICATIONS

Ranges:	0 - 100 Amperes. 0 - 10 Amperes. 0 - 1 Ampere. 0 - 100 Milliamperes. 0 - 10 Milliamperes. 0 - 1 Milliampere.
Overrange	100% up to maximum output.
Maximum Output:	100 Amperes DC or Peak AC.
DC Accuracy:	±0.02% of Range ±0.02% of Output.
AC Accuracy:	±0.1% of Range ±0.15% of Output to 1 KHz.
Input Impedance:	100K Ohms.
Compliance Voltage:	0 - 5V DC or Peak AC.
Input/Output Ratio:	1.0000 volt will produce full scale output.
Size:	10.5" H x 17" W x 17" D. (26.67 cm x 43.18 cm x 43.18 cm).
Weight:	85 lbs. net, 100 lbs. shipping. (38.25 Kg net, 45 Kg shipping).

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SECTION I
GENERAL INFORMATION

1-1 DESCRIPTION

1-2 The Valhalla Scientific Model 2555 AC-DC Current Calibrator is a complete wide range voltage-to-current convertor. It converts a precision input voltage to a proportional output current. For DC input voltages, the output current has the same polarity as the input voltage and output current magnitude is directly proportional to the magnitude of the input voltage. With an AC voltage applied to the input, the output current has the frequency and phase of the applied input voltage. Output current is then directly proportional to the value of the applied input voltage. Full scale ranges are selectable in decade increments from 1 milliampere full scale to 100 amperes full scale with front panel mounted jacks. Lighted panel indicators show when the output voltage is within limits, when it is nearing the upper limit and when that limit is exceeded. The unit is housed in a heavy duty aluminum case and is directly compatible with Retma rack mounting.

1-3 ACCESSORIES

1-4 The Model 2555 AC-DC Current Calibrator is shipped from the factory with mating 100 ampere output connectors and an instruction manual.

1-5 RACK MOUNT - OPTION R

1-6 The Model 2555 AC-DC Current Calibrator may be purchased with a rack mount adapter, OPTION R, for mounting in a standard 19-inch rack.

1-7 CABLE - OPTION C

1-8 This unit may be operated with an OPTION C Input/Output Cable Set.

SECTION II
INSTALLATION

2-1 INTRODUCTION

2-2 This section contains information for inspection and installation of the Model 2555 AC-DC Current Calibrator.

2-3 INITIAL INSPECTION

2-4 If the external shipping container shows evidence of in-transit damage, such damage should be immediately brought to the attention of the carrier and such damage noted on the bill of lading.

2-5 Unpack the instrument and retain the shipping container until the instrument has been inspected for possible damage in shipment. If in-shipment damage is observed, notify the carrier and obtain his authorization for repairs before returning the instrument to the factory. Where the external shipping container has shown evidence of damage in transit, but the instrument shows no external damage, it may be advisable to perform the calibration procedure of Section V to determine that the instrument has not incurred hidden damage.

2-6 POWER REQUIREMENTS

2-7 The Valhalla Model 2555 AC-DC Current Calibrator is normally shipped from the factory for operation from 105 to 125 volts AC at 50 to 400 Hz. The instrument may be ordered for operation from 210 to 250 volts AC. If conversion from 105-125 volts AC to 210-250 volts AC is required in the field, the factory should be contacted for instructions.

2-8 INSTALLATION

2-9 The Model 2555 AC-DC Current Calibrator may be used in a normal bench top configuration, or installed in a 19-inch rack. The instrument may then be connected to the precision reference input voltage and to the load to which current will be supplied.

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SECTION III
OPERATION

3-1 INTRODUCTION

3-2 This section of the manual contains the complete operating instructions for the Model 2555 AC-DC Current Calibrator.

3-3 INPUT VOLTAGE

3-4 The polarity and level of the input voltage determines the polarity and level of the output current. If the input voltage is zero, the output current will be zero. As the input voltage is increased, the output current will increase linearily within the selected range. For the selected range of 1 MA, an input voltage of 1.0000 volts DC will produce an output current of 1.0000 MA. If the input is increased to 1.5000 volts DC, the output current will increase to 1.5000 MA. Similarly, if the 10 MA range is selected, the output currents will be 10.000 MA and 15.000 MA for inputs of 1.0000 volts DC and 1.5000 volts DC respectively. If the input voltage is of positive polarity, the output current will be of positive polarity. If the input voltage is of negative polarity, the output current will be of negative polarity. If an AC voltage is applied to the input terminals, the output current will have the amplitude, frequency and phase characteristics of the applied input voltage.

3-5 Maximum input voltage is 2 volts RMS or DC on all but the 100 ampere range which is limited to 1 volt RMS or DC.

3-6 RANGE SWITCHING

3-7 Range switching is accomplished manually by moving the cable connections from one set of jacks to another. The instrument ranges are defined in decade increments of 1 MA, 10 MA, 100 MA, 1A, 10A and 100A based on a 1.0000 volt input reference level. For example, if the 1 MA range is selected and 1 volt applied to the input, the output current will be 1 milliampere. If a 1 volt AC RMS input is applied, the output will be 1 milliampere AC RMS. Separate heavy duty jacks are provided for the 100 ampere range. Plugs of the same current rating are supplied for insertion into these jacks. Wire size AWG #4 or larger should be used to minimize the voltage drop in the connecting leads for the 100 ampere range.

3-8 OUTPUT CURRENT

3-9 As stated in previous paragraphs, the output current is proportional to the input voltage. A 2 volt input will produce an output current which is 200% of the selected range (eg., if the 1 MA range is selected, the output current will be 2 MA). The effective output impedence of the current calibrator approaches infinity. Therefore, the output current generating circuit will attempt to deliver the requested current into any load impedance applied to the output terminals. A 1 MA current output applied to a 1K ohm load impedance produces 1 volt across that load impedance. A 1 MA input current applied to a 2K ohm load impedance produces 2 volts, etc., until the output voltage reaches the ±7 volt DC or peak AC maximum compliance level. The 7 volt DC maximum compliance voltage corresponds to 4.95 volts RMS maximum compliance voltage for sine wave output currents.

3-10 RANGE LIMIT INDICATORS

3-11 Three LED indicators (green, yellow and red) provide the operator with indication of range limit conditions. The output voltage is within limits when the green indicator is illuminated. As the input or the load

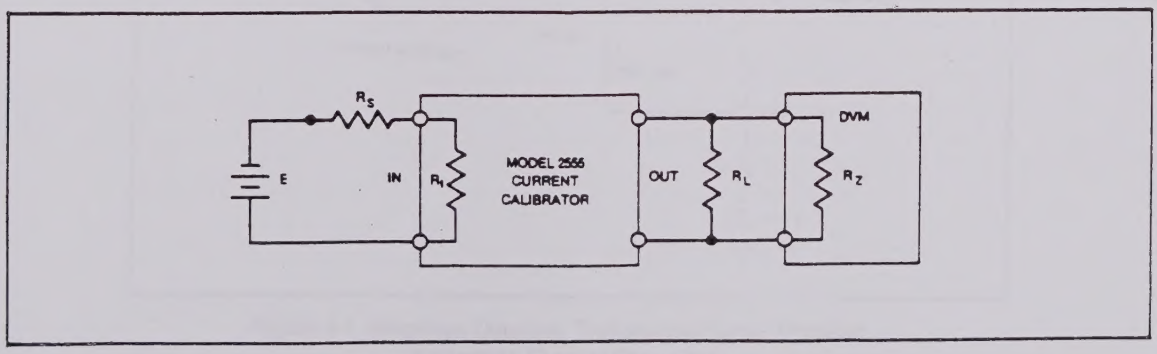


Figure 3-1. Block Diagram, DC Error Sources.

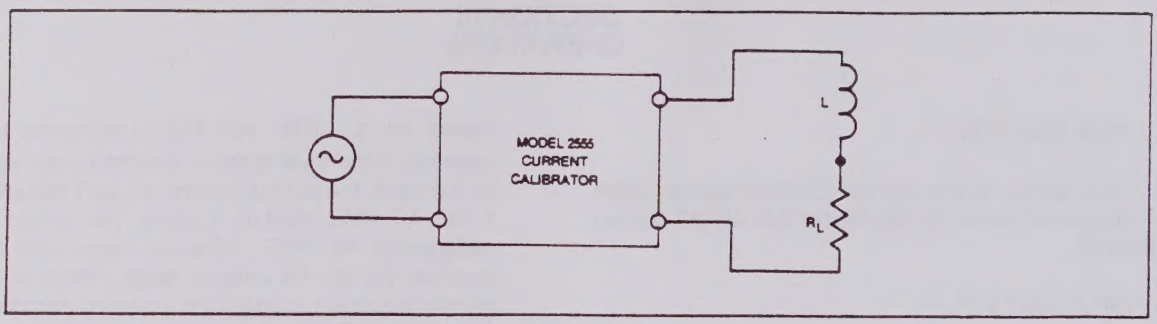


Figure 3-2. Block Diagram, AC Error Sources.

resistance is increased to the point where the output voltage is greater than ±5 volts, the green LED will be extinguished and the orange LED will light. As the output voltage increases further, the yellow LED will be extinguished and the red LED illuminated when the output voltage reaches ±7 volts.

3-12 APPLICATION INFORMATION

3-13 The application of a precision constant current source such as the Model 2555 AC-DC Current Calibrator requires a knowledge of potential outside error sources. The following paragraph outlines some of the more common error sources.

3-14 When measuring the DC current output of the AC-DC Current Calibrator, there are two primary potential error sources. The first occurs at the voltage input to the Current Calibrator. This error source is formed by the source impedance of the input voltage source, R_S, shown in Figure 3-1, forming a resistor divider with the 100K ohm input impedance of the Current Calibrator, R_I. To maintain the error at 0.01% or less, the ratio of R_I :R_S must be maintained at 10,000:1 or greater. Since R_I equals 100K ohms, the maximum impedance for R_S must be less than 10 ohms. The second potential error source occurs at the current output of the AC-DC Current Calibrator. This error source is the shunt impedance of the DVM, R_Z, shown in Figure 3-1, in parallel with the load impedance, R_L. To maintain the error at 0.01%, or less, the ratio of R_Z:R_L must be maintained at 10,000:1 or greater. If the input impedance to the DVM is 10 megohms, the maximum shunt impedance, R_L, should not exceed 1K ohms. For a shunt impedance, R_L, of 1 megohm, the input impedance to the DVM, R_Z, must be at least 10,000 megohms.

3-15 Another potential error source is inductance (L) in series with the load resistor, R_L, as shown in Figure 3-2. If the load resistance is 0.001 ohm and the series inductance is 100 nanohenries, the effective load impedance at 1 KHz is:

$$Z = \sqrt{R_L^2 + (2\pi \cdot 10\,KHz \cdot 5\mu H)^2} = 1.0481\Omega$$

SECTION IV
THEORY OF OPERATION

4-1 GENERAL

4-2 This section of the manual provides a description of the circuits of the Model 2555 AC-DC Current Calibrator. The circuit descriptions are referenced to the schematic diagram.

4-3 POWER SUPPLY

4-4 The circuits of the Model 2555 AC-DC Current Calibrator require two dual power sources. One delivers nominal positive and negative 15 volts DC and the other nominal positive and negative 10 volts DC. T1 and diodes CR10 through CR13 generate positive and negative potentials in the range of 20 volts DC. These are regulated to 15 volts DC by IC8 and IC9. The positive and negative 10 volt DC sources are obtained from a separate winding on T1 and diodes CR14 through CR17. These sources do not require regulation and are the collector supplies for Q3, Q5 through Q44 and Q46.

4-5 VOLTAGE TO CURRENT CONVERTER (TRANSCONDUCTANCE AMPLIFIER)*

4-6 A simplified diagram of the voltage-to-current converter is shown in Figure 4-1. The first amplifier, IC1, operates with a gain of 0.1 by virtue of the operational feedback loop provided by R3. The output of the first amplifier [illegible] inverting input of the second amplifier [illegible] open loop and at very high gain. The output of the second amplifier, IC2, provides a potentiometric feedback to the non-inverting input of the first amplifier. The system operates to maintain the output of the first amplifier, and the inverting input of the second amplifier, at approximately the same potential as that applied to the non-inverting input of the second amplifier. Very small differences between the inputs of the second amplifier are sufficient to drive it to full scale output.

4-7 Assume that the output terminals are shorted and 1 volt DC is applied to the input terminals with the RED input terminal positive. To equalize the inputs of the second amplifier, IC1 must be driven to zero. This is accomplished when the voltage drops across R1 and R2 are equal and those across R3 and R4 are equal. This condition will be obtained when the output of the second amplifier is at +0.1 volts. The currents through R1, R2, R3 and R4 are the same. Since the output of IC1 must be zero, the drop across R3 must be 0.05 volts, making the inverting input of IC1 +0.05 volts. R4 will have the same drop making the inverting input +0.05 volts. The drop across R1 and R2 will be 10 times as much or 0.5 volts each. Since the inputs to IC1 are essentially equal, the output of IC1 is zero (offset, of course, by the few microvolts necessary to drive the output of the second

* Patent No. 4,091,333.

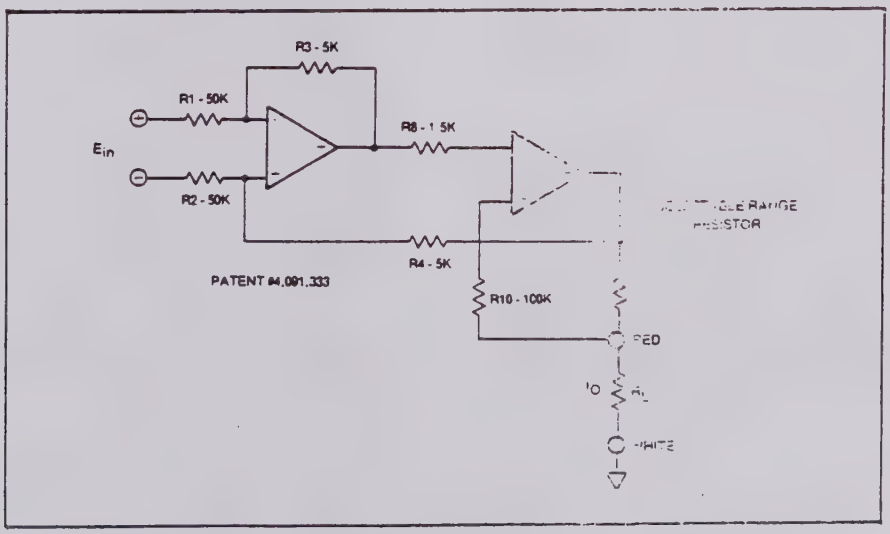


Figure 4-1. Simplified Diagram, Transconductance Amplifier. (Voltage to Current Converter)

amplifier to +0.1 volts). Note that the sum of the voltages across the four resistors, R1 through R4, equal the sum of the input voltage and second amplifier output voltage.

4-8 Consider the conditions that are obtained when the short circuit is removed from the output terminals and a 100 ohm resistor is connected across them. The reference level to the non-inverting input of the second amplifier will now be above ground due to the current through the load resistor, R_L. This will drive the output of the second amplifier in a positive direction and a point of stability will be reached when the output of the first amplifier is equal to the level applied to the non-inverting input of the second amplifier. Again, this condition is obtained when the voltage drops across R1 and R2 are equal and those across R3 and R4 are equal. This will occur when the output of the second amplifier is at 1.1 volts. The drop across the range resistor, R_S, is then 0.1 volt as it was when the output terminals were shorted. The current through the load is then 10 milliamperes. Although the resistance across the input terminals has been increased from zero to 100 ohms, the current flowing across the output terminals remains at 10 milliamperes. Note that the voltage difference between the output of the first amplifier and the second amplifier is always equal to one-tenth the voltage applied to the input terminals. When the input signal is increased to +2 volts DC, the potential difference between the output of the first amplifier and the output of the second amplifier increases to 0.2 volts. The drops across resistors R1 and R2 are then 1 volt and drops of 0.1 volt exist across R3 and R4. The current through the 100 ohm load would then increase to 20 milliamperes, proportional to the input voltage increase. If a 200 ohm resistor is connected across the output terminals, the output of the second amplifier will increase to 2.2 volts and the current through the combination of range and load resistors will remain at 20 milliamperes.

4-9 The system tends to maintain a voltage across the range resistor proportional to the input voltage. Selecting different values for the range resistor will result in different current levels through those resistors to maintain a 0.1 volt DC drop with 1 volt DC at the input terminals. The second amplifier, though shown as a single operational amplifier in the simplified diagram of Figure 4-1, is a current amplifier and actually comprised of IC2 and some 46 transistors, Q1 through Q46. The transistors are connected in four groups that are then connected in series-parallel to form a "totem pole" arrangement capable of passing 100 amperes to the load. The complete circuit is shown in the schematic diagram. Q2 and Q3 operate as constant current sources to bias the parallel connected sets of output transistors. R7 and R9 provide adjustment of the operational amplifier offsets.

4-10 RANGE SELECTION

4-11 The current output range of the Model 2555 is selected by manually inserting the load connectors into the appropriate range jacks. This inserts resistors of different values in series with the load, effectively changing the value of the range resistor of Figure 4-1. This is best illustrated by reference to the complete schematic diagram, Figure 5-2. Calibration potentiometers in the resistor matrix permit precise adjustments of the proportion between input voltage and output current. The adjustments of these potentiometers are covered in Section V.

4-12 RANGE INDICATORS

4-13 Refer to Figure 5-2. Level sensors of IC3 and IC4 provide the drive for the three range indicator LED's, DS1 through DS3. Those of IC3 compare the output of IC1, which is proportional to the output voltage to levels developed in the voltage divider comprised of R12 through R21. This divider is connected across the +15 and -15 volts supply lines. The inputs to IC3-1 and IC3-7 from the divider are positive with respect to ground and those to IC3-8 and IC3-14 are negative. When the output Of IC1 is between 0 and +5 volts, all of IC3's outputs are at -15V and the junction of R22, R23 and R28 is at -10V. Thus the output of IC4-1 and IC4-7 are also at -15V which forces the output of IC4-8 to +15V to light DS3 (GRN). As the output transitions +5V, the output of IC7-3 goes to +15V, forcing the output of IC4-1 to +15V, turning on DS2 (YEL), forcing the output of IC4-8 to -15V which extinguishes DS3. As the voltage transitions to +7 volts, the output of IC3-1 goes to +15V. This forces the output of IC4-7 to 15V, turning on DS1. The output of IC4-1 is forced low, turning off DS2. The output of IC4-7 holds IC4-8 at -15V, keeping DS3 turned off.

4-14 When the output is forced in the negative direction, a similar sequence occurs. However, IC3-8 and IC3-14 outputs will transition rather than those of IC3-7 and IC3-1.

SECTION V
MAINTENANCE

5-1 INTRODUCTION

5-2 This section contains the maintenance information for the AC-DC Current Calibrator. Included in this section are the required test equipment lists, calibration procedures, and troubleshooting guide.

5-3 CALIBRATION PROCEDURE

5-4 The following procedures should be performed on a routine basis to ensure that the instrument remains within calibration. The calibration procedures should also be performed after repairs to any of the accuracy determining components.

5-5 REQUIRED TEST EQUIPMENT

5-6 The test equipment required for the calibration procedures is shown in Table 5-1.

5-7 100 AMPERE RANGE

5-8 Connect the equipment as shown in Figure 5-1 with connections to the Model 2555 and Model 2575 100 ampere jacks. Set the DC Voltage Standard to zero volts. Adjust R7, on the circuit board, for an indication on the DC Nullmeter of ± 100 microvolts, or less.

NOTE

If the calibration is being performed because IC2 was replaced, set R7 to mid-range and adjust for an indication on the Nullmeter of ±100 microvolts, or less.

5-9 Set the DC Voltage Standard for 1.00 volts. Verify that the Nullmeter indication is ±400 microvolts, or less. Verify, also, that the DVM reading is 1.00 volts.

NOTE

If the specified indications are not obtained, it will be necessary to file or shunt resistor R110 if the DVM reading is not as specified. Internal adjustments are not provided for the 100 ampere range and these methods are necessary to bring the DVM reading within limits.

5-10 10 AMPERE RANGE

5-11 Make connections to the Model 2555 and Model 2575 10 ampere jacks. Set the DC Voltage Standard to zero volts. Check for an indication on the Nullmeter of ±100 microvolts. Adjust R7, if required.

5-12 Set the DC Voltage Standard to 1.00 volts. Adjust R108 for an indication on the Nullmeter of ±400 microvolts.

5-13 Adjust R45 for an indication on the DVM of 1.00 volts.

5-14 1 AMPERE RANGE

5-15 Make connections to the Model 2555 and Model 2575 1 ampere jacks. Set the DC Voltage Standard to zero volts. Check for an indication on the Nullmeter of ±100 microvolts, or less. Adjust R7, if required.

Table 5-1. Required Test Equipment.

ITEM	REQUIRED ACCURACY
DC Voltage Standard	0-1V DC, ±0.003% Accuracy.
5-Digit DVM	±0.003% Accuracy, 10 Megohms Input Impedance on 1 V DC Range.
Thermal Transfer System	Fluke Model 540, or equivalent.
AC Voltmeter	Hewlett Packard 3450A001, or equivalent.
AC Voltage Standard	Optimation Model 126, or equivalent.
External Shunt System	Valhalla Model 2575, or equivalent.

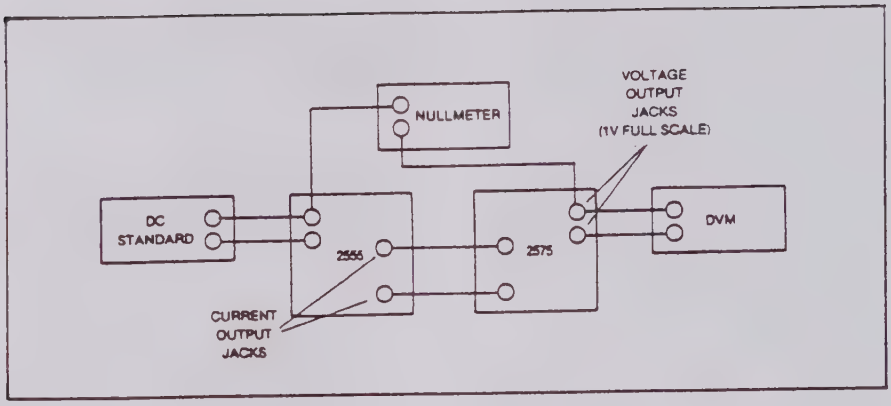


Figure 5-1. DC Test Equipment Setup.

5-16 Set the DC Voltage Standard to 1.00 volts. Adjust R105 for an indication on the Nullmeter of ±400 microvolts, or less.

5-17 Adjust R42 for an indication on the DVM of 1.00 volts.

5-18 100 MILLIAMPERE RANGE

5-19 Make connections to the Model 2555 and Model 2575 100 milliampere jacks. Set the DC Voltage Standard to zero volts. Check for an indication on the Nullmeter of ±100 microvolts, or less. Adjust R7, if required.

5-20 Set the DC Voltage Standard to 1.00 volts. Adjust R102 for an indication on the Nullmeter of ±400 microvolts, or less.

5-21 Adjust R39 for an indication on the DVM of 1.00 volts.

5-22 10 MILLIAMPERE RANGE

5-23 Make connections to the Model 2555 and Model 2575 10 milliampere jacks. Set the DC Voltage Standard to zero volts. Check for an indication on the Nullmeter of ±100 microvolts, or less. Adjust R7, if required.

5-24 Set the DC Voltage Standard to 1.00 volts. Adjust R99 for an indication on the Nullmeter of ±400 microvolts, or less.

5-25 Adjust R36 for an indication on the DVM of 1.00 volts.

5-26 1 MILLIAMPERE RANGE

5-27 Make connections to the Model 2555 and Model 2575 1 milliampere jacks. Set the DC Voltage Standard to zero volts. Check for an indication on the Nullmeter of ±100 microvolts, or less. Adjust R7, if required.

5-28 Set the DC Voltage Standard to 1.00 Volts. Adjust R96 for an indication on the Nullmeter of ±400 microvolts, or less.

5-29 Adjust R33 for an indication on the DVM of 1.00 volts.

5-30 FREQUENCY RESPONSE

5-31 The frequency response test need not be performed on a routine basis as the 1 KHz bandwidth is inherent in the design. The frequency response test is an exacting procedure requiring specialized test

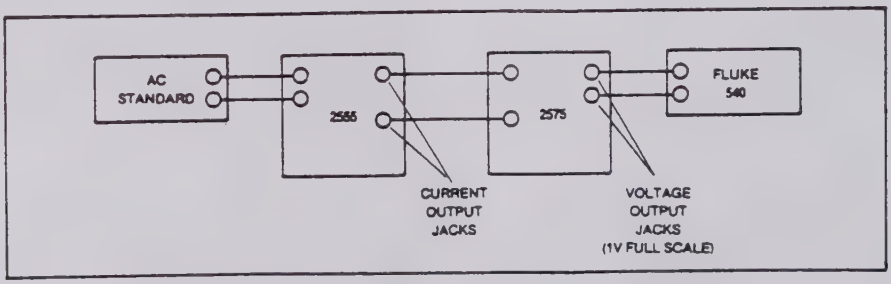


Figure 5-2. AC Frequency Response Test Setup.

equipment listed in Table 5-1 but not usually found in most service laboratories. Before attempting to perform this test, it is recommended that paragraph 3-12, Application Information, be completely reviewed and that the test operator thoroughly understand the sources of errors and compensates for them during the test. If test equipment other than that listed in Table 5-1 is to be used, a comparison of the specifications for the equipment listed and that to be used must be made to insure that the equipment used is an exact replacement.

5-32 100 AMPERE RANGE

5-33 Connect the equipment as shown in Figure 5-2. Set the Model 540 Mode switch to the AC Transfer position and the Range switch to 1V range. Make connections to the Model 2555 and Model 2575 100 ampere jacks.

5-34 Set the AC Voltage Standard to 100 Hz and 1.00 volts RMS. Null the Model 540 galvanometer to zero.

5-35 Increase the frequency output of the AC Voltage Standard to 1000 Hz and verify that the output does not change by more than 0.25% from that measured in 5-34.

5-36 10 AMPERE RANGE

5-37 Make connections to the Model 2555 and Model 2575 10 ampere jacks. Repeat the steps of paragraphs 5-34 through 5-35.

5-38 1 AMPERE RANGE

5-39 Make connections to the Model 2555 and Model 2575 1 ampere jacks. Repeat the steps of paragraphs 5-34 through 5-35.

5-40 100 MILLIAMPERE RANGE

5-41 Make connections to the Model 2555 and Model 2575 100 milliampere jacks. Repeat the steps of paragraphs 5-34 through 5-35.

5-42 10 MILLIAMPERE RANGE

5-43 Make connections to the Model 2555 and Model 2575 10 milliampere jacks. Repeat the steps of paragraphs 5-34 through 5-35.

5-44 1 MILLIAMPERE RANGE

5-45 Make connections to the Model 2555 and Model 2575 1 milliampere jacks. (If the load for the Model 2555 is something other than the Model 2575, the total shunt capacitance, including leads and resistor capacitance, must not exceed 200 picofarads). Repeat the steps of paragraphs 5-34 through 5-35.

NOTE

For factory certifications with National Bureau of Standards traceability, contact your local Valhalla sales representative or Valhalla Scientific, Inc.

5-46 RANGE INDICATOR ADJUSTMENT

5-47 Connect the DC Standard plus (+) output terminal to the plus (RED) input terminal of the Model 2555 and the minus (-) output to the minus (WHITE) output of the Model 2555. Connect a 5K ohm resistor across the 1 MA output jack of the Model 2555 and connect the DVM across the resistor. Increase the DC Standard output until the DVM reads +5 volts. Adjust R19 to just turn on the yellow panel indicator. The green indicator will be turned off. Increase the DC Standard output for a +7 volt reading on the DVM. Adjust R15 to just turn on the red indicator. The yellow indicator will be turned off. Reverse the polarity of the input to the Model 2555 and repeat the procedure but adjust R17 and R13 instead of R9 and R15.

5-48 TROUBLESHOOTING

5-49 Difficulties with precision equipment often arise due to misinterpretation of the specifications. Make a careful check with precision test equipment to determine that the instrument is malfunctioning before proceeding with repair procedures.

5-50 POWER SUPPLIES

5-51 The 20 volt power supplies are formed by CR14, CR15, CR16 and CR17. These supplies are unregulated and the voltage will vary from 18.5V to 21.8V depending on line voltage and load.

5-52 The 15 volt power supplies are formed by integrated circuit voltage regulators IC8 and IC9. Their voltages will vary slightly from unit to unit due to component tolerances and will typically be near 14.2V.

5-53 The 5V supplies for the current shunt amplifier are comprised of CR1 through CR4 and integrated circuit amplifiers IC5 and IC6. These voltages will vary slightly from unit to unit and are typically 4.95 volts.

5-54 AMPLIFIER SERVICING

5-55 Before attempting to service the amplifiers of the Model 2555, it is recommended that the technician review the theory of operation provided in Section IV. The following procedure is only an aid to isolate a catastrophic malfunction to a local area. Short the input terminals and short the output terminals. With the dif-

ferential DC voltmeter, measure the voltage between the common connections of the power transistor emitter resistors and pin 6 of IC1. This voltage must be less than 15 millivolts. If it is greater than 15 millivolts, IC1 is, most likely, defective. If it is less than 15 millivolts, the malfunction is somewhere in the second amplifier (and/or) the current amplifiers), or the feedback network.

NOTE

If IC1, IC2, Q6 through Q14, Q16 through Q24, Q26 through Q34, Q36 through Q44 or R95 through R110 are replaced, the AC FREQUENCY RESPONSE TEST MUST BE PERFORMED. Contact your Valhalla sales representative or Valhalla Scientific, Inc. if the AC Frequency Response test is not satisfactory.

C11
C12

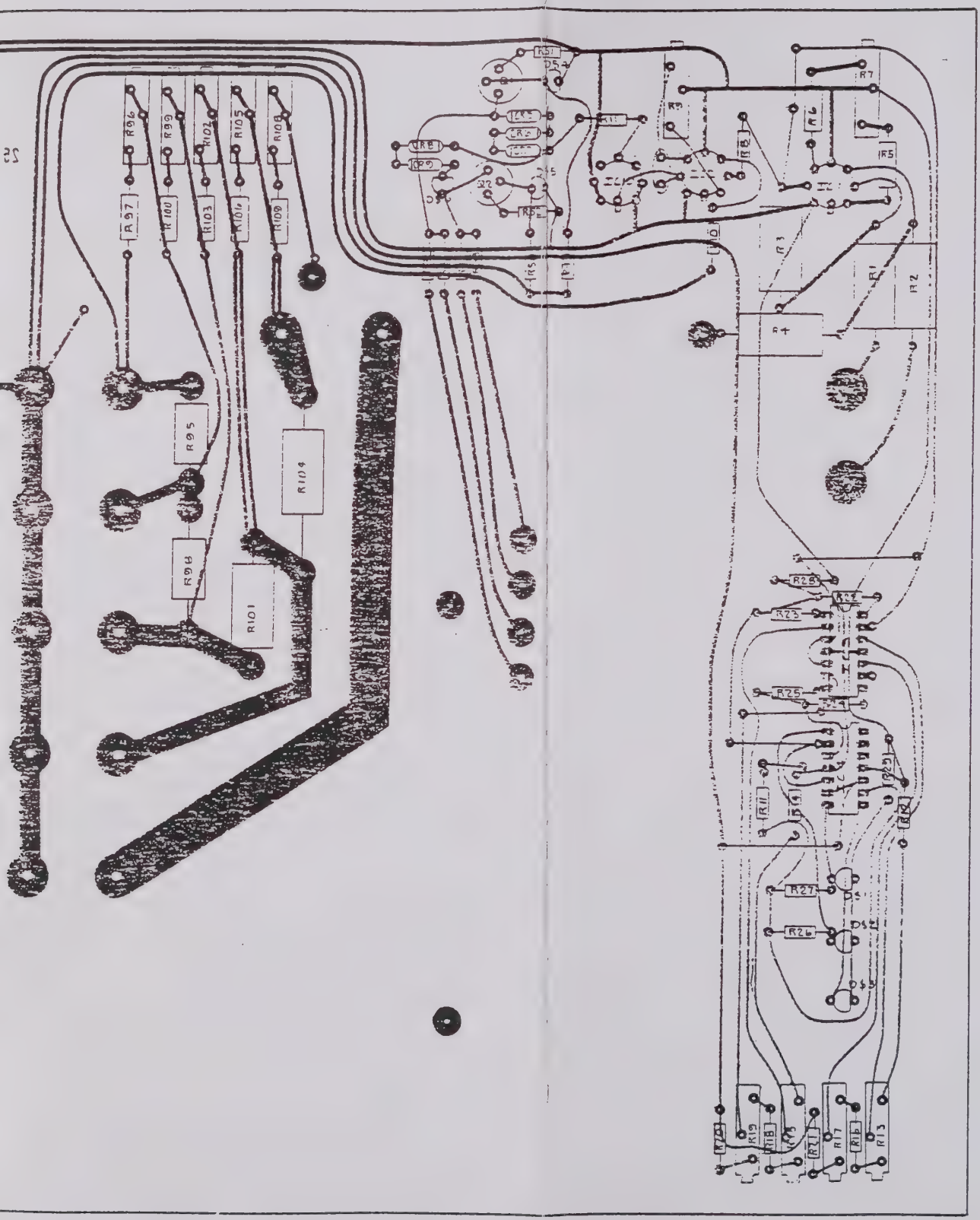
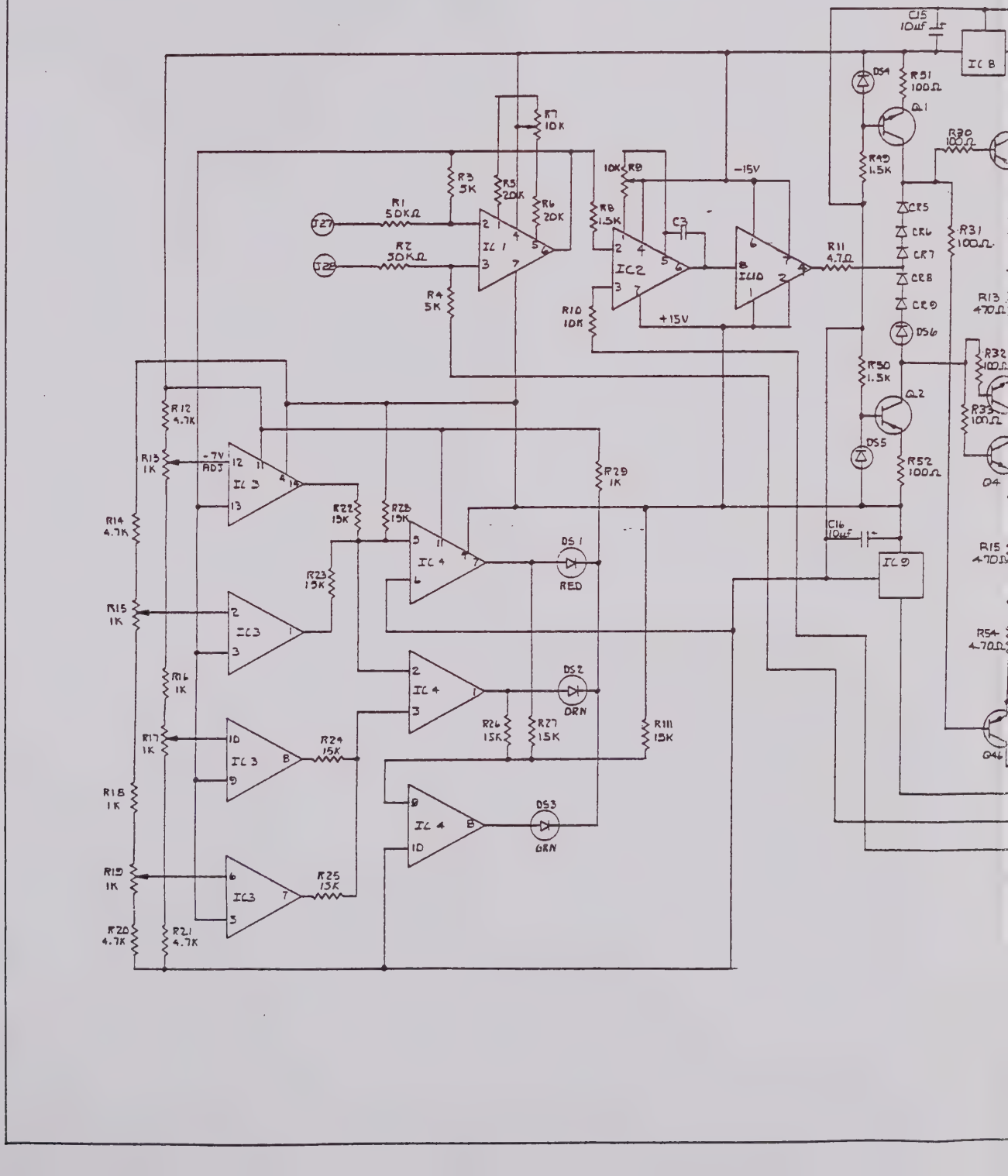


Figure 5-3. Circuit Board Component Locations (Assembly).


C15
10µF
IC 8
DS4
R51
100Ω
Q1
R30
100Ω
R49
4.5K
R7
10K
R3
5K
R5
20K
R6
20K
10K R9
-15V
R1
50KΩ
R2
50KΩ
IC 1
IC2
C3
R8
1.5K
IC10
R11
4.7Ω
CR5
CR6
CR7
CR8
CR9
R31
100Ω
R13
470Ω
DS6
R4
5K
R10
10K
+15V
R50
1.5K
Q2
R32
100Ω
R33
100Ω
DS5
R52
100Ω
Q4
R12
4.7K
R13
1K
-7V
ADJ
IC 3
R29
1K
R14
4.7K
R22
15K
R28
15K
IC 4
DS1
RED
C16
10µF
IC 9
R15
470Ω
R23
15K
R15
1K
IC3
R54
470Ω
DS2
GRN
R16
1K
R26
15K
R27
15K
R111
15K
R17
1K
R24
15K
R18
1K
DS3
GRN
R19
1K
R25
15K
R20
4.7K
R21
4.7K
Q46

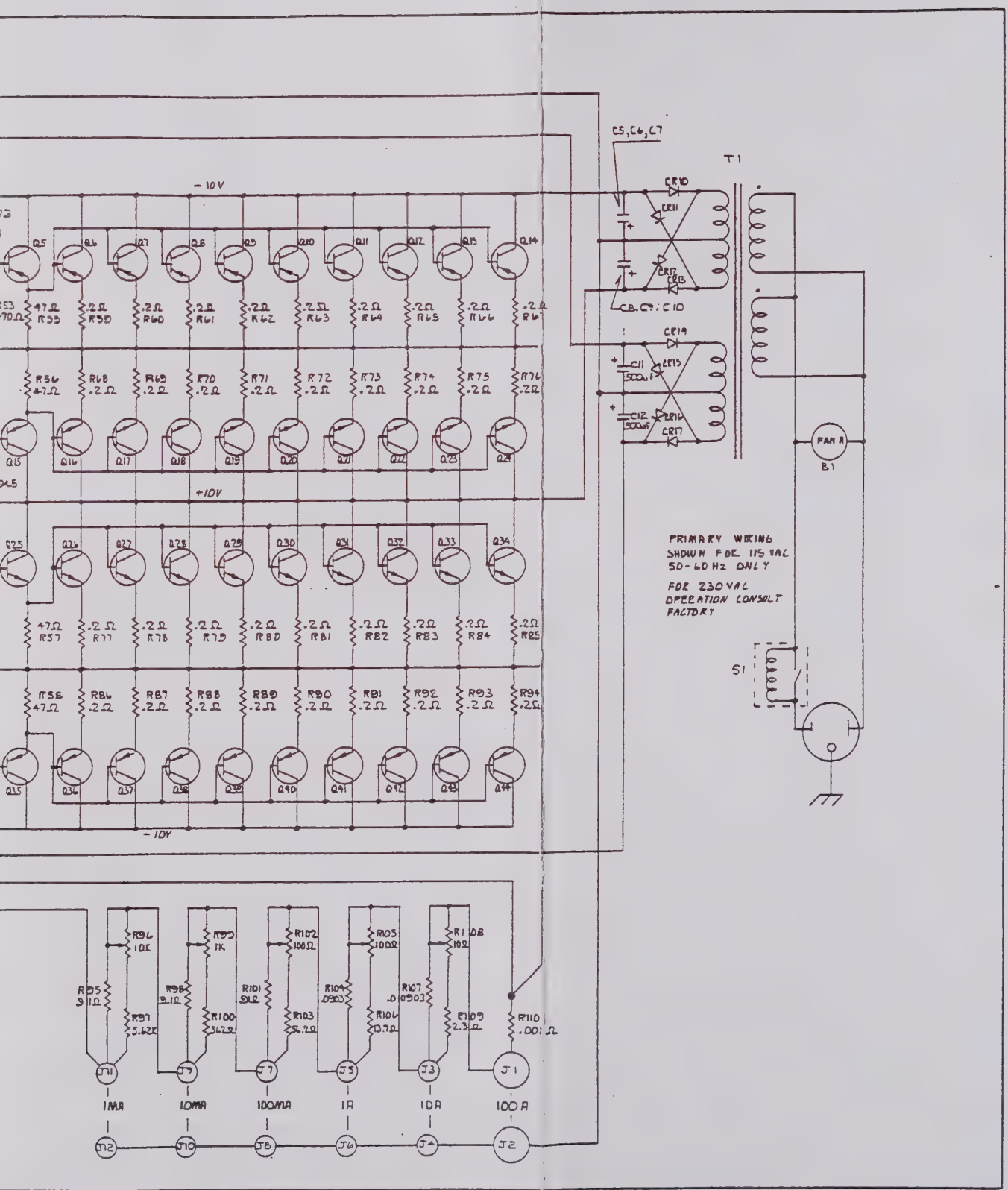


Figure 5-4. Schematic Diagram, Model 2555 AC-DC Current Calibrator.

Valhalla Scientific Inc

PARTS LIST

REF. DES.	V.S. P/N	DESCRIPTION	MFG.	MFG. P/N
B1	5-10092	10" Fan	82877	CL2L2
Q3, 45	3-10002	TRANSISTOR, PNP		2N4036
Q4, 46	3-10007	TRANSISTOR, NPN		2N2102
Q5-24	3-10009	TRANSISTOR PNP		2N6248
Q25-44	3-10008	TRANSISTOR NPN		2N3055
R13, 15, 53, 54	1-01033	RES FXD 470Ω 5%	81349	RC07GF471J
R55-58	1-01015	RES FXD 47Ω 5%	81349	RC07GF470J
R59-94	1-30008	RES FXD 0.2Ω 8 W	90201	HHJ 0.2
1 ea	5-10109	HEAT SINK	ASTRODYNE	2602-0708-0A
1 ea	5-10119	STRAIN RELIEF	LAPP	L-11
1 ea	5-10110	FINGER GUARD	82877	476323
1 ea	5-10107	POWER CORD	70903	17629
1 ea	4-10103	REAR PANEL	53504	2555-200A
6 ea	4-10134	H.S. STRAP	53504	2555-212
1 ea	4-10110	H.S. BKT	53504	2555-207
4 ea	4-10116	OUTPUT BUS BAR	53504	2555-214
4 ea	4-10117	OUTPUT BUS BAR BKT	53504	2555-213
8 ea		3/8-24 x 1" BOLTS		
8 ea		3/8-24 NUTS		
1 ea	4-10141	100A STANDOFF	53504	2555-218A
1 ea	4-10139	OUTPUT S BRACKET	53504	2555-216
R107*	1-20045	RES FXD .00903Ω	MTD	1-20045
R110*	1-20052	RES FXD .001Ω	MTD	1-20052

*Installed in final test

MODEL:	TITLE:	SHT
2555	OUTPUT ASSEMBLY	1 OF 1

Valhalla Scientific Inc

PARTS LIST

REF. DES.	V.S. P/N	DESCRIPTION	MFG.	MFG. P/N
C3	2-10001	CAP CERM 200pf	56289	5GAT20
C15, 16	2-30001	CAP TAN 10µf/16V	05397	T360B106M025AS
C11, 12	2-40008	CAP ELEC 500/50	56289	TVA-1315
CR5-9	3-20000	DIODE		1N914
CR 14-17	3-20002	DIODE, RECT		1N4001
DS 1	5-01011	LED, RED		5082-4655
DS 2	5-01012	LED, YELLOW		5082-4555
DS 3	5-01013	LED GREEN		5082-4955
DS 4-6	5-01005	LED	00001	MV5074
IC 1, 2	3-30041	OP AMP	BURR BRN	3521-L
IC 3,4	3-30031	QUAD OP AMP	27014	LM324N
IC 8	3-30037	IC REG - 15V	27014	LM320T-15
IC 9	3-30036	IC REG + 15	27014	LM340T-15
IC 10	3-30069	OP AMP	27014	LH0002CH
J 1	5-10104	RECPT 100A - RED	58474	RS100GR
J 2	5-10103	RECPT 100A - WHT	58474	RS100GWT
J 3, 5, 7, 9, 11, 27	5-10021	BINDING POST - RED	83330	#257-RED
J 4, 6, 8, 10, 12	5-10102	BINDING POST - WHT	83330	#257- WHT
J 28	5-10020	BINDING POST - BLK	83330	#257- BLK
P1	5-10106	PLUG - 100A - RED	58474	PP100GR
P2	5-10105	PLUG - 100A - WHT	58474	PP100GWT
Q1	3-10007	TRANSISTOR - NPN	27014	2N2102
Q 2	3-10002	TRANSISTOR - PNP	27014	2N4036
R1, 2	1-20034	RES WW 50 K .01%	53504	1-20034 50KΩ
R3, 4	1-20035	RES WW 5K .01%	53504	1-20035 5KΩ
R5, 6	1-10012	RES MF 20K 1%	81349	RN60C2002F
R 7, 9, 96	1-50023	RES VAR 10K	80294	3006P-1-103
R 8, 49, 50	1-01043	RES CF 1.5K 5%	81349	RC07GF152J
R10	1-01061	RES CF 10K 5%	81349	RC07GF103J
R 11	1-01004	RES CF 4.7Ω5%	81349	RC07GF4R7J
R 12, 14, 20, 21	1-01053	RES CF 4.7K 5%	81349	RC07GF472J
R 13, 15, 17, 19, 99	1-50022	RES VAR 1K	80294	3006P-1-102
R 16, 18, 29	1-01041	RES CF 1K 5%	81349	RC07GF102J
R 22-28, 111	1-01063	RES CF 15K 5%	81349	RC07GF153J
R 30-33, 51, 52	1-01021	RES CF 100Ω 5%	81349	RC07GF101J
R95	1-20041	RES WW 91Ω .1%	53504	1-20041
R 97	1-10042	RES MF 5.62K 1%	81349	RN60C5621F
R 98	1-20042	RES WW 9.1Ω .1%	53504	1-20042
R 100	1-10043	RES MF 562Ω 1%	81349	RN60C5620F

MODEL:	TITLE:	SHT OF
2555	F. P. & P. C. Assembly	1 3

Valhalla Scientific Inc

PARTS LIST

REF. DES.	V.S. P/N	DESCRIPTION	MFG.	MFG. P/N
R 101	1-20043	RES WW .91Ω .1%	53504	1-20043
R 102, 105	1-50025	RES VAR 100Ω	80294	3006P-1-101
R 103	1-10044	RES MF 56.2Ω	81349	RN60C5622F
R 106	1-10045	RES MF 13.7Ω 1%	81349	RN60D13R7F
R 104	1-20044	RES WW .091Ω .1%	53504	1-20044
R 108	1-50021	RES VAR 10Ω	80294	3006P-1-100
R 109	1-10046	RES MF 2.3Ω	81349	RN60D2R30F
S1	5-03014	20A CIRCUIT BREAKER	74193	JA1-A3-A-20-2
1 ea	4-30032	P.C. BOARD	53504	2555-700A
1 ea	4-10108	FRONT PANEL	53504	2555-205A
2 ea	4-10136	P.C. ANGLE BKT	53504	2555-215
1 ea	4-10140	10A INTERCONN BKT	53504	2555-217

MODEL:	TITLE:	SHT OF
2555	F.P. & P.C. Assembly	2 3

Valhalla Scientific Inc

PARTS LIST

REF. DES.	V.S. P/N	DESCRIPTION	MFG.	MFG. P/N
C 5-10	2-40007	CAP ELEC 110,000/20V	00853	500R114U020Df2B
CR 10, 11	3-20013	DIODE, RECT		1N3288A
CR 12, 13	3-20014	DIODE RECT		1N3288AR
T1	4-20014	POWER TRANSFORMER	53504	2550-010
1 ea	4-10104	CAP BKT	53504	2555-201
1 ea	4-10105	INSULATOR	53504	2555-202
2 ea	4-10106	BUSS BAR	53504	2555-203
1 ea	4-10107	GND BAR	53504	2555-204
2 ea	4-10125	H.S. BKT	53504	2555-209
2 ea	4-10126	RECT H.S.	53504	2555-210
2 ea	4-10127	XFORMER BKT	53504	2555-211
1 ea	4-10135	CHASSIS	TDJ	B-S1050-17-1700H
12 ea		10-32 x 1" HEX HEAD MACH SCREWS		
12 ea		#10 FLAT WASHERS		
12 ea		#10 SPLIT RING LOCK WASHERS		
6 ea		1/4-28 x 3/8 BOLT		
10 ea		1/4" LOCK WASHER		
4 ea		1/4-20 x 4-1/2 BOLT		
4 ea		1/4-20 HEX NUT		
10 ea		CRIMP LUG	BELDEN	716796
10 ea		CRIMP LUG	"	708226
15 feet		#4 AWG WIRE	"	7704

MODEL:	TITLE:	
2555	Power Supply	SHT 3 OF 3

FEDERAL SUPPLY CODE
for
MANUFACTURERS CATALOGING HANDBOOK H4-1

00001	Monsanto, Electronic Special Products, Cupertino, Calif.
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01121	Allen-Bradley Company, Milwaukee, Wisc.
01255	Litton Industries, Inc., Beverly Hills, Calif.
01281	T R W Semiconductors, Inc., Lawndale, Calif.
01295	Texas Instruments, Inc., Dallas, Texas
02335	Fairchild Controls Corp., Hicksville, LI, N.Y.
02660	Amphenol Corporation, Broadview, N.Y.
03507	General Electric Company, Syracuse, N.Y.
04713	Motorola Semiconductor Prod., Inc., Phoenix, Ariz.
04963	3-M, St. Paul, Minn.
05276	Pomona Electronics Co., Inc., Pomona, Calif.
05397	Kemet, Union Carbide Corp., Cleveland, Ohio
05820	Wakefield Engineering, Inc., Wakefield, Mass.
07088	Kelvin Electric Company, Van Nuys, Calif.
07256	Silicon Transistor Corp., Garden City, N.Y.
07263	Fairchild Camera and Instr. Corp., Mt. View, Calif.
07716	I R C, Incorporated, Burlington, Iowa
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09026	Babcock Electronics Corp., Costa Mesa, Calif.
12405	Hysol Corporation, El Monte, Calif.
12406	Elpac, Incorporated, Fullerton, Calif.
12697	Clarostat Mfg. Co., Incorporated, Dover, N.H.
13454	Texas Crystals, River Grove, Ill.
14655	Cornell-Dubilier Elect. Corp., Newark, N.J.
14752	Electro Cube, Incorporated, San Gabriel, Calif.
16758	Delco Radio Div., General Motors, Kokomo, Ind.
17838	Mektron, California General, Inc., Chula Vista, Calif.
18324	Signetics, Sunnyvale, Calif.
18722	R C A, Mountaintop, Pa.
21604	Buckeye Stamping Company, Columbus, Ohio
25684	Victoreen Instrument Co., Inc., Oak Lawn, Ill.
27014	National Semi-Conductor Corp., Santa Clara, Calif.
27556	IMB Electronic Products, Santa Fe Springs, Calif.
28480	Hewlett-Packard Co., Palo Alto, Calif.
30983	Electra/Midland, San Diego, Calif.
44655	Ohmite Manufacturing Company, Skokie, Ill.
71279	Cambridge Thermionic Corp., Cambridge, Mass.
71400	Bussmann Mfg. Div., McGraw-Edison Co., St. Louis, Mo.
71450	CTS Corporation, Elkhart, Ind.
71468	ITT Cannon Electric, Inc., Los Angeles, Calif.
71590	Centralab Div., Globe-Union, Inc., Milwaukee, Wisc.
71785	Cinch Manufacturing Company, Chicago, Ill.
73899	J F D Electronics Company, Brooklyn, N.Y.
75915	Littlefuse, Incorporated, Des Plaines, Ill.
76055	Mallory Controls, Frankfort, Ind.
76493	J. W. Miller Company, Los Angeles, Calif.
78488	Stackpole Carbon Company, St. Marys, Pa.
80294	Bourns, Incorporated, Riverside, Calif.
81095	Triad Transformer Corp., Venice, Calif.
81312	Winchester Electronics, Oakville, Ct.
81349	Military Spec., Standardization Division, Chicago, Ill.
82389	Switchcraft, Incorporated, Chicago, Ill.
83330	Herman H. Smith, Inc., Brooklyn, N.Y.
84171	Arco Electronics, Inc., Great Neck, N.Y.
86684	R C A, Harrison, N.J.
88245	Useco Div., Litton Industries, Van Nuys, Calif.
90201	Mallory Capacitor Company, Indianapolis, Ind.
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91929	Micro Switch Div., Honeywell, Inc., Freeport, Ill.
92194	Alpha Wire Corporation, Elizabeth, N.J.
93332	Sylvania Electric Products, Inc., Woburn, Mass
98978	IERC, Burbank, Calif.
00002	Jordan Electronics, Van Nuys, Calif.
53504	Valhalla Scientific, Inc., San Diego, Calif.

MODEL 2555

AC-DC CURRENT CALIBRATOR

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